APPLICATION

FOR

UNITED STATES OF AMERICA

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SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that I,

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have invented certain improvements in

"AXIAL PISTON PUMP DRIVEN BY AN ELECTRIC MOTOR"

of which the following description in connection with the accompanying drawings is a specification, like reference characters on the drawings indicating like parts in the several figures.

The present invention relates to a hydraulic axial piston pump driven by an electric motor.

BACKGROUND OF THE INVENTION

Currently, in axial piston pumps there are three main constructive solutions: pumps with an inclined swash plate and an aligned oscillating cylinder block, pumps with a perpendicular swash plate and an inclined cylinder block, and pumps with an oscillating swash plate and an aligned fixed cylinder block.

With particular reference to this last constructive solution, although similar remarks can be made for the other types, the pump is constituted by an outer casing in which the cylinder block is arranged in alignment with the rotation axis of the pivot on which the oscillating swash plate is keyed.

The pivot of the oscillating swash plate protrudes from the casing and a crown gear is keyed on its outer part and meshes with a pinion that is functionally connected to the electric motor of the pump.

The electric motor is fixed to a flange, which is connected to a corresponding flange that is formed monolithically with the casing; the space for the crown gear and the pinion is formed between the two flanges.

This pump configuration, though having been commercially available for a long time, suffers from drawbacks.

Fitting the motor flange to the casing flange, for example, is troublesome as regards both to the double fixing operation (motor flange to motor and subsequent fixing to the casing flange) and the correct positioning of the components between the two flanges; during the assembly of these components it is in fact necessary to try to reduce the concentricity errors that are produced during mutual coupling.

These concentricity errors, which cannot always be eliminated acceptably, lead to imbalances of the rotating masses, with consequent problems in terms of vibration, bearing wear, et cetera.

Moreover, these flanges are typically made of metallic material and accordingly increase significantly the total weight of the device in which they are included, particularly if said device has a structure made of plastics.

SUMMARY OF THE INVENTION

The aim of the present invention is to provide a hydraulic axial piston pump driven by an electric motor that solves the problems described above in known types.

Within this aim, an object of the present invention is to provide a hydraulic axial piston pump driven by an electric motor that simplifies the coupling of the electric motor to the casing.

Another object of the present invention is to provide a hydraulic axial piston pump driven by an electric motor that reduces the concentricity errors generated in coupling the components of the pump and reduces the rotating masses.

Another object of the present invention is to provide a hydraulic axial piston pump driven by an electric motor that can be manufactured at a lower cost than currently manufactured pumps.

Another object of the present invention is to provide a hydraulic axial piston pump driven by an electric motor that is lighter than currently manufactured pumps.

Another object of the present invention is to provide a hydraulic axial piston pump driven by an electric motor that can be manufactured with known equipment and technologies.

This aim and these and other objects that will become better apparent hereinafter are achieved by a hydraulic axial piston pump driven by an electric motor, characterized in that it comprises an outer casing that is formed monolithically with elements for fixing said casing to the stator assembly of the electric motor, said electric motor being thus coupled directly to said casing.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a partially sectional plan view of an electric motor coupled to a casing of a pump according to the invention;

Figure 2 is a front view of the pump casing according to the invention, to which an electric motor is coupled;

Figure 3 is a partially sectional side view of a portion of a pump according to the invention, illustrating in particular the casing of the pump;

Figure 4 is an exploded view of a portion of the pump according to the invention, illustrating in particular the motor, the casing and the components inside the casing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the figures, a hydraulic axial piston pump driven by an electric motor according to the invention is generally designated by the reference numeral 10.

Said pump comprises a casing 11 inside which an oscillating swash plate 11a is accommodated.

In practice, the swash plate 11a is formed by a rotating disk-like body 10a on which a central hub 12 is formed.

The central hub 12 has an axial through hole for coupling to a rotation pivot 13 that is hinged with respect to the casing 11.

The disk-like body 10a has an annular seat 14 that is inclined with respect to the rotation axis of said disk-like body.

Sliding means for heads 19 of axial pistons 20 of the pump formed by the casing 11 are accommodated in the annular seat 14.

The pistons 20 are inserted slidingly in a cylinder block 20a, which is fixed to the casing 11 by means of brackets, and are associated with return

springs 20b.

Said sliding means are constituted by a first thrust bearing 16 on which a roller cage 17 rests; in turn, a second thrust bearing 18 rests on the roller cage 17 and is directly in contact with the heads 19 of the pistons 20.

The swash plate 11a comprises, on the peripheral region of the disk-like body 10a, which is formed monolithically therewith, a toothed circumferential portion 21 that is coaxial to the rotation axis of the swash plate 11a.

The toothed circumferential portion 21 is kinematically coupled to an actuation gear 22, for example a pinion, which is functionally connected to an electric motor 23 of the pump by way of an output shaft 24 of said electric motor; the shaft 24 supports said pinion at its end and is keyed directly to the casing 11.

Advantageously, the outer casing 11 is formed monolithically with elements 25 for fixing said casing to a stator assembly 26 of the electric motor 23.

In this manner, the electric motor 23 is coupled directly to the casing 11.

The fixing elements 25 are constituted by first complementarily threaded bores 27, which are formed along the front peripheral region of the casing 11 and are arranged coaxially to corresponding second complementarily threaded holes 28, which are formed parallel to the rotation axis of the electric motor 23 on the stator assembly 26; in particular, the complementarily threaded holes 28 are formed through the lamination pack of the stator assembly 26.

Corresponding threaded elements 29 for connection between the motor 23 and the casing 11 are arranged through the bores 27 and the complementarily threaded holes 28.

Said threaded elements are constituted for example by a self-tapping screw.

The casing 11 is preferably made of plastics.

In practice it has been found that the invention thus described solves the problems noted in known types.

It is noted that a pump has been provided which integrates monolithically the casing and the flange of the electric motor.

In this manner, the number of components of the pump are reduced and pump assembly is simplified considerably, reducing production costs as a whole.

Moreover, the structure is lightened, with evident benefits in structural and functional terms.

In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

The disclosures in Italian Utility Model Application No. PD2003U000012 from which this application claims priority are incorporated herein by reference.